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**Satellite Earth Stations and Systems (SES);
Radio Frequency and Modulation Standard
for Telemetry, Command and Ranging (TCR)
of Communications Satellites**

Reference

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

National transposition dates	
Date of adoption of this EN:	20 September 2017
Date of latest announcement of this EN (doa):	31 December 2017
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2018
Date of withdrawal of any conflicting National Standard (dow):	30 June 2018

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document applies to the Telemetry, Command and Ranging (TCR) system of Communication Satellites (geosynchronous or not), operating in the following frequency bands:

- 5 725 MHz to 7 025 MHz uplink, 3 400 MHz to 4 200 MHz and 4 500 MHz to 4 800 MHz downlink ("C-band");
- 12 750 MHz to 13 250 MHz, 13 750 MHz to 14 800 MHz and 17 300 MHz to 18 400 MHz uplink, 10 700 MHz to 12 750 MHz and 13 400 MHz to 13 650 MHz downlink ("Ku-band");
- 27 500 MHz to 30 000 MHz uplink, 17 700 MHz to 20 200 MHz downlink ("Commercial Ka-band").

Although not explicitly addressed in the present document, possible usage in other bands allocated to FSS/MSS/BSS/SOS between 1 GHz to 51,4 GHz may be envisaged.

The TCR receiver and transmitter can have a frequency flexibility capability over a given RF band, Typical frequency step is 100 kHz.

The present document sets out the minimum performance requirements and technical characteristics of the ground/satellite Radio Frequency (RF) interface based on Frequency Modulation (FM), Phase Modulation (PM) and Code Division Multiple Access (CDMA).

With the growing number of satellites, the co-location constraints and the maximization of bandwidth for Communications Missions, real and potential interference cases have motivated the elaboration of the present document for geostationary satellites based on CDMA techniques.

The present document addresses the following applications:

- Telemetry.
- Command (Telecommand).
- Ranging.
- Hosted Payload Management.

The aim of the present document is to replace and enhance the prior document ETSI EN 301 926 [i.2] (V1.2.1). The present document's provisions also apply for use cases of autonomous control of hosted payloads. It is recognized that hosted payloads may require only a subset of the functionality.

The present document applies to the typical TCR scenario shown on figure 1. The scenario includes multiple satellites, which may be located in the same orbital location (GSO), or that can be in common view of a given TCR station during NGSO phases (such as transfer phase to GEO, or during NGSO operations). These satellites may be controlled by m different TCR ground stations. The TCR links defined in the present document have also to coexist with the communication ground terminals also shown on figure 1. Some of the satellites to be controlled may use FM/PM waveforms, and some may use a CDMA waveform, as defined later in the present document.

The scenario may also include, for some of the satellites, hosted payloads, which can be controlled independently of the satellite platform and of the main payload.

The present document defines the modulation and coding on the TCR and HPM links. Modulation formats are specified in clause 4 and coding in clause 7.